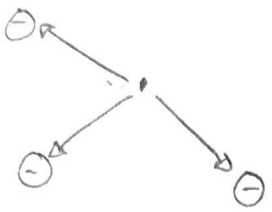
Conceptual

1.) E

2.)



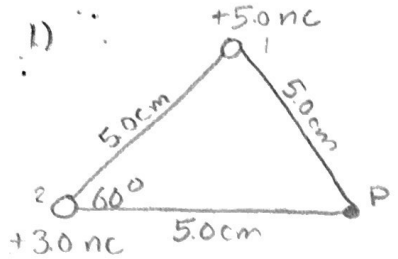
C

3.) C

4.) C

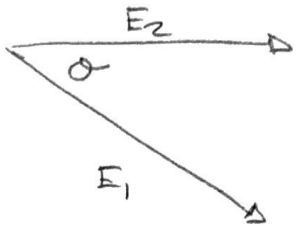
5.) b

1)



Point charge

$$E = \frac{kq}{r^2}$$



a)

$$E_{1P} = \frac{k(-5.0\times10^{-9}C)}{(5.0\times10^{-2}m)^2} \qquad E_{1P} = 1.798\times10^{4}\,N/C$$

$$E_{2P} = \frac{k(3.0\times10^{-9}C)}{(5.0\times10^{-2}m)^2} \qquad E_{2P} = 1.078\times N/C\uparrow$$

E_1: $E_{1x} = E_1\cos60 = 8990\,N/C\uparrow$

$E_{1Y} = -E_1\sin60 = -15,571.1\,N/C\downarrow$

$$E_N = 1.98\times10^{4}\,N/C\uparrow - 1.56\times10^{4}\,N/C\downarrow$$

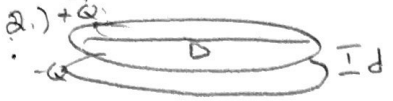
b.)

$E = 2.52\times10^{4}\,N/C$

$\theta = 38.2°$ CW from x-axis

$$\theta = \tan^{-1}\left(\frac{-1.56\times10^{4}}{1.98\times10^{4}}\right)$$

$\theta = 38.2°$ CW from x-axis

2.) 

a.) $E_{cap} = \frac{\eta}{\epsilon_0}$

$\eta = \frac{Q}{A} = 5.66 \times 10^{-6} C/m^2$

$Q = 16 \times 10^{-9} C$

$A = \pi (3.0 \times 10^{-2} m)^2$

$E_{cap} = 6.39 \times 10^5 N/C$

b.) $u: \quad u_0 + K_0 = u_1 + K_1$

$u_0 = K_1$

$u = qE\Delta s \qquad u = 2.049 \times 10^{-16} J$

$q = 1.602 \times 10^{-19} C$

$E = 6.39 \times 10^5 N/C$

$\Delta s = 2.0 \times 10^{-3} m$

$u = \frac{1}{2} m v^2$

$2u = m v^2$

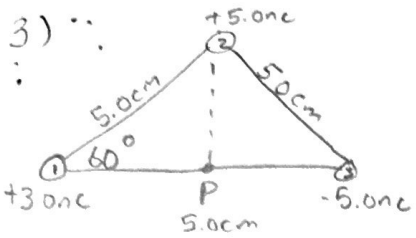
$\frac{2u}{m} = v^2$

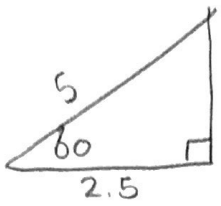
$v = \sqrt{\frac{2u}{m}}$

$m = 1.67 \times 10^{-27} kg$

$v = 4.95 \times 10^5 m/s$

3) ∴





$y = 4.33\,cm$

a.) $u_E = \frac{Kq_1q_2}{r}$

$u_E = u_{12} + u_{23} + u_{13}$

$u_{12} = \frac{K(3.0\times10^{-9}C)(5.0\times10^{-9}nc)}{5.0\times10^{-2}m} = 2.697\times10^{-6}J$

$u_{23} = \frac{K(5.0\times10^{-9}C)(-5.0\times10^{-9}nc)}{5.0\times10^{-2}m} = -4.495\times10^{-6}J$

$u_{13} = \frac{K(3.0\times10^{-9}C)(-5.0\times10^{-9}C)}{5.0\times10^{-2}m} = -2.697\times10^{-6}J$

$u = -4.495\times10^{-6}J$

b.) $V = \frac{Kq}{r}$

$V = V_{1P} + V_{2P} + V_{3P}$

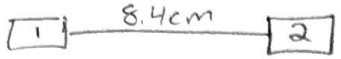
$V_{1P} = \frac{K(3.0\times10^{-9}C)}{2.5\times10^{-2}m} = 1078.8\,V$

$V_{2P} = \frac{K(5.0\times10^{-9}C)}{4.33\times10^{-2}m} = 1038.11\,V$

$V_{3P} = \frac{K(-5.0\times10^{-9}C)}{2.5\times10^{-2}m} = -1798\,V$

$V = 318.9\,V$

4.) ∴



$q_1 = -2.8\times10^{-9}C$ $\quad$ $q_2 = -5.6\times10^{-9}C$

a.) $F = \frac{Kq_1q_2}{r^2}$

$F = \frac{K(-2.8\times10^{-6}C)(-5.6\times10^{-6}C)}{(8.4\times10^{-2}m)^2} = 19.97N$ $\quad$ $F = 19.97N$

b.) $u = \frac{K(-2.8\times10^{-6}C)(-5.6\times10^{-6}C)}{(8.4\times10^{-2}m)} = 1.678\,J$ $\quad$ $u = 1.678\,J$

c) $u = u_0 + K_0 = u_1 + K_1$

$u_0 = K_1 \quad 2K_1$

$u = mv^2$

$\sqrt{\frac{u}{m}} = v$

$V = 25.9\ m/s$ $\quad$ $V = 25.9\ m/s$